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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/992,250 | 11/14/2001 | Steve H. Halfmann | 170-99-X03 | 5824 |

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| EXAMINER | |
|---|---|
| VERDIER, CHRISTOPHER M | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 3745 | |

DATE MAILED: 05/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/992,250 | HALFMANN ET AL. | |
| | Examiner | Art Unit | |
| | Christopher Verdier | 3745 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *18 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-5,8-26 and 29-51* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *21-24* is/are allowed.

6)☒ Claim(s) *1-5,8,12-16,20,25,26,29,30,32-39,43-49 and 51* is/are rejected.

7)☒ Claim(s) *9-11,17-19,31,40-42 and 50* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 November 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *3-18-04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

### *Continued Examination Under 37 CFR 1.114*

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on March 18, 2004 has been entered.

The indicated allowability of claims 1-5, 8, 12-16, 20, 25-26, 29-30, 32-39, 43-49, and 51 is withdrawn in view of the newly cited references in the Information Disclosure Statement of March 18, 2004. Rejections based on the newly cited reference(s) follow.

### *Claim Objections*

Claims 25-26 and 29-33 are objected to because of the following informalities: Appropriate correction is required.

In claim 25, line 5, "units" should be changed to – circuits --.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 13-14, 25-26, and 34-37 are rejected under 35 U.S.C. 102(b) as being anticipated by Moore 5,702,232 (figures 2-3). Note the air-cooled turbine blade 20, the blade having an airfoil shape defined by a convex suction side wall, a concave pressure side wall, a leading edge 30, a trailing edge 32, a root 34 and a tip 36, the walls, edges, root and tip forming an interior for receiving blade cooling circuits, with the turbine blade comprising a plurality of independent cooling circuits 56, 57, 58 within the interior, one of the cooling circuits 56 being positioned to cool the pressure side wall and one other of the cooling circuits 57 being positioned to cool the suction side wall, the plurality of cooling circuits are mechanically interconnected to one another, and two of the cooling circuits 57, 57 are positioned to cool the suction side wall, one closer to the leading edge and one closer to the trailing edge, and one of the plurality of cooling circuits 58 is positioned substantially in the center of the interior. The cooling circuit positioned substantially at the center of the interior comprises walls (see the wall connected to the leading edge 30 and the wall connecting to 62) having greater thickness than the walls of the pressure side and suction side cooling circuits. Also disclosed is a method for improving the cooling effectiveness of the air-cooled turbine blade, comprising providing the plural independent cooling circuits, positioning one of the cooling circuits 58 substantially in the center of the interior, providing the center-positioned cooling circuit with thicker walls than the walls of the remaining cooling circuits, and injecting cooling air into each cooling circuit through respective unnumbered independent air inlets, positioning one of the cooling circuits 57 adjacent the suction side wall, and positioning one of the cooling circuits 56 adjacent the pressure side wall. A first of the cooling circuits 56 is positioned to cool the pressure side wall, a second of the cooling

circuits 57 is positioned to cool the suction side wall, and a third 58 of the cooling circuits is positioned substantially in the center of the interior.

Claims 13-14, 16, 25-26, and 34-37 are rejected under 35 U.S.C. 102(b) as being anticipated by European Patent 1,065,343 (figures 2-3). Note the air-cooled turbine blade 14, the blade having an airfoil shape defined by a convex suction side wall 26, a concave pressure side wall 24, a leading edge 28, a trailing edge 30, a root 18 and a tip 34, the walls, edges, root and tip forming an interior for receiving blade cooling circuits, with the turbine blade comprising a plurality of independent cooling circuits 38, 64, 72 within the interior, one of the cooling circuits 64/40 being positioned to cool the pressure side wall and one other of the cooling circuits 72 being positioned to cool the suction side wall, the plurality of cooling circuits are mechanically interconnected to one another, and two of the cooling circuits 38, 72 are positioned to cool the suction side wall, one 38 closer to the leading edge and one 72 closer to the trailing edge, and one of the plurality of cooling circuits 64 is positioned substantially in the center of the interior. The cooling circuit positioned substantially at the center of the interior comprises walls (near 54, 56, 26, and 24 in figure 3) having greater thickness than the walls of the pressure side and suction side cooling circuits. The suction side cooling circuit closer to the leading edge comprises a plenum 66 positioned adjacent the tip for cooling the tip. Also disclosed is a method for improving the cooling effectiveness of the air-cooled turbine blade, comprising providing the plural independent cooling circuits, positioning one of the cooling circuits 64 substantially in the center of the interior, providing the center-positioned cooling circuit with thicker walls than the walls of the remaining cooling circuits, and injecting cooling air into each cooling circuit through

respective independent air inlets 22, positioning one of the cooling circuits 72 adjacent the suction side wall, and positioning one of the cooling circuits 64/40 adjacent the pressure side wall. Concerning claim 34, a first of the cooling circuits 38 is positioned to cool the pressure side wall, a second of the cooling circuits 72 is positioned to cool the suction side wall, and a third 64 of the cooling circuits is positioned substantially in the center of the interior. Concerning claim 37, two of the cooling circuits are positioned to cool the suction side wall, one 38 closer to the leading edge and one 72 closer to the trailing edge.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-5, 8, 44-46, 48-49, and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Corsmeier 5,813,835 in view of Hucul 4,236,870. Corsmeier (figures 4-8) discloses an air cooled turbine blade 10 having an airfoil shape 16 defined by a convex suction side wall 20, a concave pressure side wall 18, a leading edge 17, a trailing edge 19, a root 12, and an unnumbered tip, with the walls, edges, root and tip forming an interior for receiving blade cooling circuits, with plural independent cooling circuits within the interior, with one circuit 22 being positioned to cool the pressure side wall and another cooling circuit 24 being positioned to cool the suction side wall, with the plural cooling circuits comprising respective individual air inlets near 22, 24, with the cooling circuits being mechanically interconnected to one another via formation of the blade out of its material. The plural cooling circuits comprise two of the circuits 28, 24 positioned to cool the suction side wall, one 28 closer to the leading edge and one 24 closer to the trailing edge. The cooling circuit 26 is positioned substantially in the center of the interior. The suction side cooling circuit 28 closer to the leading edge comprises a plenum (unnumbered, near 52 in figure 6) positioned adjacent the tip for cooling the tip. Corsmeier also discloses the method of improving cooling effectiveness of the blade, by providing the plural independent cooling circuits and injecting cooling air into each cooling circuit through respective independent air inlets near 22, 24, and 28. One cooling circuit 24 is positioned adjacent the suction side wall, and one cooling circuit 22 is positioned adjacent the pressure side wall, and cooling circuit 26 is positioned substantially in the center of the interior. One of the cooling circuits 28 is positioned adjacent the leading edge, and the leading edge adjacent the cooling circuit has a plenum (near 52) positioned for cooling the tip. The suction side adjacent the cooling circuit has an out of plane serpentine bend above 32 (figure 6).

However, Corsmeier does not disclose that the pressure side wall cooling circuit comprises a serpentine passage having a plurality of pin fins and a turning vane (claim 1), does not disclose that one of the cooling circuits comprises a serpentine passage having a plurality of pin fins and a turning vane (claim 44), and does not disclose that the pressure side wall cooling circuit comprises a serpentine passage having a plurality of pin fins and a turning vane (claim 48).

Hucul (figures 1-2) shows an air cooled turbine blade having a pressure side wall cooling circuit 32 adjacent to pressure side 14 which comprises a serpentine passage 34, 36 having a plurality of pin fins 60 and a turning vane 66, for the purposes of controlling flow separation of flow in the serpentine passage to prevent hot spots and enhancing cooling efficiency.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to form the turbine blade of Corsmeier such that the that the pressure side wall cooling circuit 22 comprises a serpentine passage having a plurality of pin fins and a turning vane, as taught by Hucul, for the purposes of controlling flow separation of flow to prevent hot spots and enhancing cooling efficiency.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Corsmeier 5,813,835 and Hucul 4,236,870 as applied to claim 1 above, and further in view of Hoff 5,462,405. The modified turbine blade of Corsmeier shows all of the claimed subject matter

except for the pressure side wall cooling circuit comprising a super charger channel bypassing the serpentine passage.

Hoff (figure 1) shows a turbine blade having a pressure side wall cooling circuit near 26 comprising a super charger channel 94 bypassing a serpentine passage 84, 82, 92, for the purpose of allowing unused cooler air from inlet 26 to cool the passage 92, thereby increasing the cooling of passage 92.

It would have been further obvious at the time the invention was made to a person having ordinary skill in the art to form the modified turbine blade of Corsmeier such that the pressure side wall cooling circuit 22 comprises a super charger channel bypassing the serpentine passage, as taught by Hoff, for the purpose of allowing unused cooling air to cool part of the serpentine passage, thereby increasing cooling of the passage.

Claims 15, 29, 33, 38, 44-45, and 46-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over European Patent 1,065,343 in view of Hucul 4,236,870. European Patent 1,065,343 disclose a turbine blade substantially as claimed as set forth above, including a pressure side wall cooling circuit 64, and a method of improving cooling effectiveness of the blade, by providing the plural independent cooling circuits and injecting cooling air into each cooling circuit through respective independent air inlets 22, with one of the cooling circuits 64 comprising a serpentine passage. One cooling circuit 72 is positioned adjacent the suction side wall, and one cooling circuit 64/40 is positioned adjacent the pressure side wall, and cooling

circuit 64 is positioned substantially in the center of the interior. The center-positioned cooling circuit comprises walls (near 54, 56, 26, and 24 in figure 3) having greater thickness than the walls of the pressure side and suction side cooling circuits.

However, European Patent 1,065,343 does not disclose that the pressure side wall cooling circuit comprises a serpentine passage having a plurality of pin fins and a turning vane (claims 15, 29, 38 and 48), does not disclose that one of the cooling circuits comprises a serpentine passage having a plurality of pins and a turning vane (claim 44), and does not disclose optimizing the configuration of the plurality of pins to maximize heat transfer and optimizing the configuration of the turning vane to minimize flow separation (claim 33).

Hucul (figures 1-2) shows an air cooled turbine blade having a pressure side wall cooling circuit 32 adjacent to pressure side 14 which comprises a serpentine passage 34, 36 having a plurality of pin fins 60 and a turning vane 66, for the purposes of controlling flow separation of flow in the serpentine passage to prevent hot spots and enhancing cooling efficiency.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to form the turbine blade of European Patent 1,065,343 such that the that the pressure side wall cooling circuit 64/40 comprises a serpentine passage having a plurality of pin fins and a turning vane, as taught by Hucul, for the purposes of controlling flow separation of flow to prevent hot spots and enhancing cooling efficiency.

Concerning the recitation in claim 33 of optimizing the configuration of the plurality of pins to maximize heat transfer and optimizing the configuration of the turning vane to minimize flow separation, Official Notice is taken that it is desirable to generally optimize arrangements in order to maximize desirable features while minimizing undesirable features, in order to increase efficiency. Therefore, it would have been further obvious to optimize the configuration of the plurality of pins to maximize heat transfer and optimize the configuration of the turning vane to minimize flow separation, for the purpose of increasing efficiency.

Claims 20 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over European Patent 1,065,343 and Hucul 4,236,870 as applied to claims 15 and 38, respectively above, and further in view of Hoff 5,462,405. The modified turbine blade of European Patent 1,065,343 shows all of the claimed subject matter except for the pressure side wall cooling circuit comprising a super charger channel bypassing the serpentine passage.

Hoff (figure 1) shows a turbine blade having a pressure side wall cooling circuit near 26 comprising a super charger channel 94 bypassing a serpentine passage 84, 82, 92, for the purpose of allowing unused cooler air from inlet 26 to cool the passage 92, thereby increasing the cooling of passage 92.

It would have been further obvious at the time the invention was made to a person having ordinary skill in the art to form the modified turbine blade of European Patent 1,065,343 such that the pressure side wall cooling circuit 64/40 comprises a super charger channel bypassing the

serpentine passage, as taught by Hoff, for the purpose of allowing unused cooling air to cool part of the serpentine passage, thereby increasing cooling of the passage.

Claims 25-26, 30, 32, 34-37, and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Levengood 4,753,575 in view of European Patent 1,065,343. Levengood (figure 4) discloses a method for improving the cooling effectiveness of a fluid-cooled turbine blade 10, with the blade having an airfoil shape defined by an unnumbered convex suction side wall, an unnumbered concave pressure side wall, a leading edge 26', a trailing edge near 14', a root 12' and a tip 56', the walls, edges, root and tip forming an interior for receiving blade cooling circuits, comprising providing plural independent cooling circuits 46', 74', 52', positioning one of the cooling circuits 74' substantially in the center of the interior, and injecting cooling air into each cooling circuit through respective independent air inlets 44', 100, 38', positioning one of the cooling circuits 74' adjacent the suction side wall, and positioning one of the cooling circuits 46' adjacent the pressure side wall. One of the cooling circuits 52' is positioned adjacent the leading edge, and the leading edge adjacent the cooling circuit has a plenum 54' positioned for cooling the tip. The suction side adjacent cooling circuit 74' has an out of plane serpentine bend 110. A first of the cooling circuits 46' is positioned to cool the pressure side wall, a second of the cooling circuits 52' is positioned to cool the suction side wall, and a third of the cooling circuits 74' is positioned substantially in the center of the interior. The plurality of cooling circuits are mechanically interconnected to one another. Two of the cooling circuits 52', 46' are positioned to cool the suction side wall, one 52' closer to the leading edge and

one 46' closer to the trailing edge. The suction side cooling circuit 52' closer to the leading edge comprises a plenum 54' positioned adjacent the tip for cooling the tip.

However, Levengood does not disclose that the turbine blade is air-cooled, and does not disclose providing the center-positioned cooling circuit with thicker walls than the walls of the remaining cooling circuits.

European Patent 1,065,343 (figures 2-3) shows a cooled turbine blade 14, which is cooled by air (paragraph 18), for the purpose of using high pressure air from a compressor to cool the blade, allowing high pressure air to flow through the various blade passages to ensure adequate blade cooling. A center-positioned cooling circuit 64 is provided with thicker walls (near 54, 56, 26, and 24 in figure 3) than the walls of the remaining cooling circuits, for the purpose of providing more blade strength in the center of the blade.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to form the turbine blade of Levengood such that the turbine blade is air-cooled, as taught by European Patent 1,065,343, for the purpose of allowing high pressure air to flow through the various blade passages to ensure adequate blade cooling, and to form the turbine blade of Levengood such that the center-positioned cooling circuit has thicker walls than the walls of the remaining cooling circuits, as taught by European Patent 1,065,343, for the purpose of providing more blade strength in the center of the blade.

***Allowable Subject Matter***

Claims 21-24 are allowed.

Claims 9-11, 17-19, 31, 40-42, and 50 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher Verdier whose telephone number is (571) 272-4824. The examiner can normally be reached on Monday-Friday from 10:00-6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward K. Look can be reached on (571) 272-4820. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

C.V
April 29, 2005

Christopher Verdier
Primary Examiner
Art Unit 3745